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# CONSERVING OUR HERITAGE AMERICA'S BIODIVERSITY



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CATALOGING PREP.

"IF THE LAND MECHANISM AS A WHOLE IS GOOD, THEN EVERY PART IS GOOD, WHETHER WE UNDERSTAND IT OR NOT. IF THE BIOTA, IN THE COURSE OF EONS, HAS BUILT SOMETHING WE LIKE BUT DO NOT UNDERSTAND, THEN WHO BUT A FOOL WOULD DISCARD SEEMINGLY USELESS PARTS? TO KEEP EVERY COG AND WHEEL IS THE FIRST PRECAUTION OF INTELLIGENT TINKERING."

Aldo Leopold

*The Round River*



Leopold's famous words of caution, written in the 1940s, seem far-sighted from the vantage point of the 1990s. Today, more than ever, they also speak

to the heart of the motto of the U.S.D.A. Forest Service: "**Caring for the Land and Serving the People.**"



Biodiversity is essential to conserve our nation's renewable natural resources, including the ecosystems that will support future generations. In fact, biodiversity has become a major national and international issue. One result is a growing base of support for the idea that decisions about the future of our forests



and wildlands should be guided by a broader set of values and uses.

But what exactly is biodiversity, and how does one go about conserving it while providing all the other things we want from productive wildlands?

## WHAT IS BIODIVERSITY?

Biodiversity, a shortened version of the term "biological diversity," can be defined simply as the variety of life and its processes, but little else about it is simple. Biodiversity includes all life forms, from one-celled fungi, protozoa, and bacteria to complex organisms such as plants, insects, fishes, and mammals. And it includes the millions of processes, pathways, and cycles that link living organisms into populations, ecosystems, and ultimately the entire biosphere that is the planet Earth.

This variety of life is dynamic and constantly changing. Some changes are subtle, such as alterations in the genetic composition of populations; others are dramatic, such as plant species succession after fires or floods. Change, which is neither good nor bad in itself, is the reason that biodiversity cannot be assessed simply at a single point in time.

For a long time, concerns about biodiversity have focused on threatened and endangered species of plants and animals, but these represent only one aspect of a larger issue: conservation of the full variety of life, from genetic variation in species populations to the full richness of ecosystems on Earth.

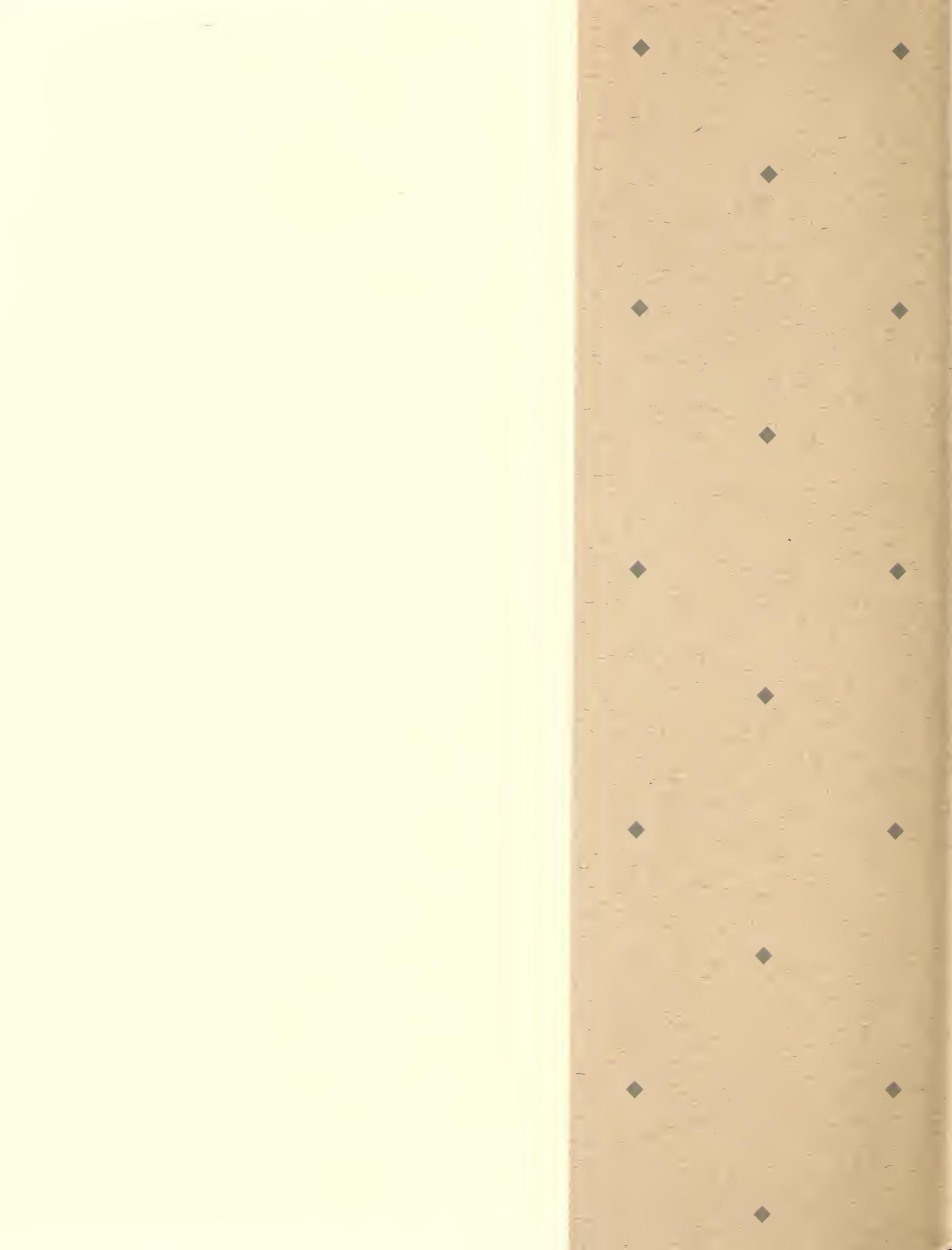
Because biodiversity is so complex, it is useful to consider the different *levels* of biodiversity, from the narrowest to the broadest perspective.

**Genetic diversity**—the variety of genetic building blocks found among individual representatives of a species. Although less obvious than species diversity,

Glacier National Forest, Alaska  
Photo: R. Scott, Top Photo  
Photo: R. Scott, Bottom Photo

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genetic diversity is crucial to a species' survival. A varied gene pool provides for resilience in the face of environmental stresses, a hedge against an unknown future that allows a species to adapt to changing conditions.

**Species diversity**—the variety of living organisms found in a particular place, for example, the hundreds of different species found in a ponderosa pine forest stand, including plants, birds, mammals, and a host of less visible organisms. This is the level of biodiversity that usually receives the most attention. To address species diversity properly, one must consider how it changes from place to place, and over time at the same place.

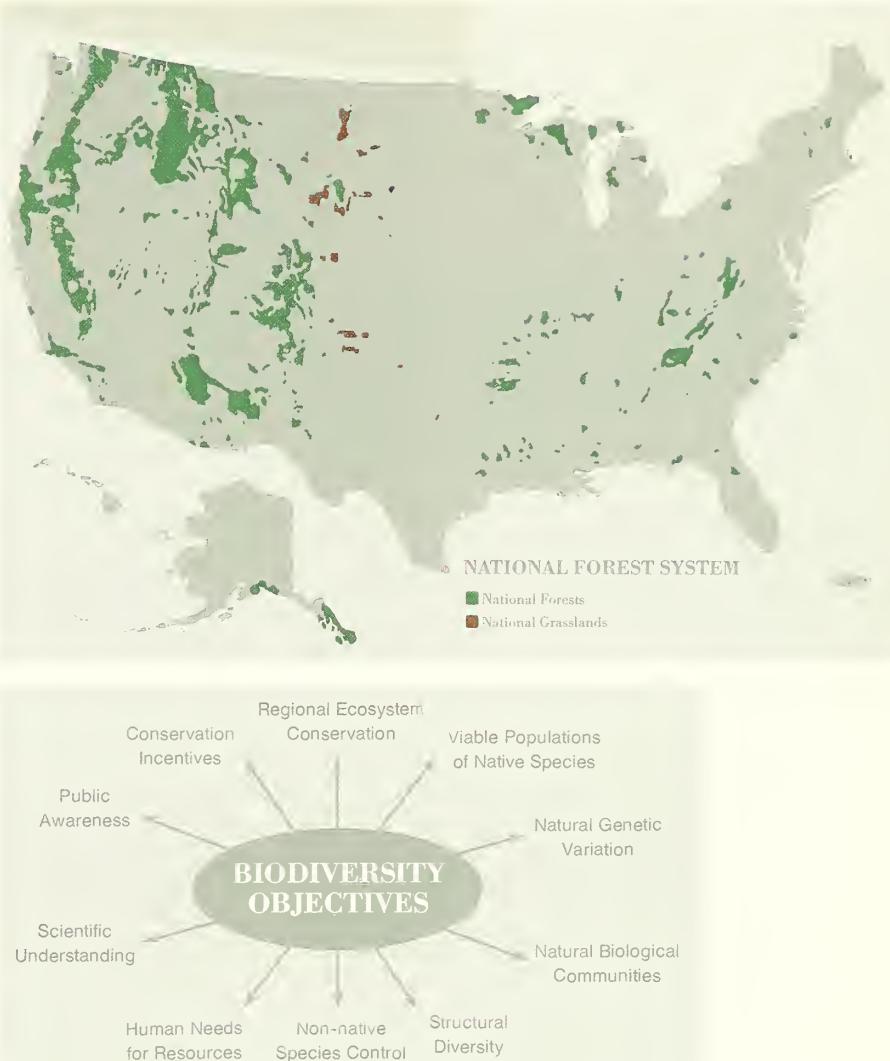
**Ecosystem diversity**—the variety of species and ecological processes—both their kind and their number—that occur in different physical settings. Examples of ecosystems include an old-growth forest, a riparian area, or Sonoran desert.

**Landscape diversity**—the geography of different ecosystems across a large area and the connections among them. For example, a landscape interspersed with grasslands, shrublands, meadows, ponds, streams, wetlands, and forests has more diversity than one with a broad expanse of mostly grassland.

By these definitions, it is easy to see that the Earth's biodiversity is extraordinary and precious.

### WHY IS BIODIVERSITY IMPORTANT?

Why should people care about protecting biodiversity? Why should they



support the effort required to sustain and enhance genetic resources, recover endangered species, restore riparian areas, maintain ancient forests, or conserve trees, insects, and marshes? The answer touches on ethics, esthetics, economics, and quality of life.

The diversity of life benefits us in infinite ways:



◆ Our homes, air, livestock, vegetables, fruits, and grains all derive from the products of diverse and healthy ecosystems.

◆ More than half of all our medicines today can be traced to wild organisms; one-quarter of all prescriptions written in the United States every year contain chemicals from plants.

◆ Diverse communities of plants, animals, and microorganisms provide indispensable ecological services: they recycle wastes, maintain the chemical composition of the atmosphere, and play a major role in determining the world's climate.

◆ Countless people enjoy the special pleasures of hiking in lush forests, visiting scenic mountains and seashores, and pursuing recreational activities that are dependent on biodiversity, such as hunting and fishing.

Many people believe that we have an ethical obligation to protect the diversity of living things with which we share our planet,

whether or not they are known to be useful to us, simply because humans bear a responsibility for the stewardship of all life on Earth.

Yet, the full values of biodiversity far exceed our current knowledge. Despite decades of scientific effort, we know only a small fraction of the species on

this planet; every day species are lost before we have a chance to learn anything about them. We will never know which potential foods, medicines, and commercial products have disappeared forever with each extinction.

An astonishing wealth of wild plants, animals, and microorganisms have served humans since we first walked on Earth. Future generations are entitled to expect, and will need, an environment as biologically rich as the one inherited by today's generations.

#### **WHAT IS THE U.S.D.A. FOREST SERVICE DOING ABOUT BIODIVERSITY?**

Since its creation in 1905, the Forest Service has been entrusted with management of the National Forest System. With passage of the Multiple Use Sustained Yield Act in 1960 and the National Forest Management Act in 1976, the Forest Service's role was further refined to balance demands that were often in conflict: demands for forest products, and demands to protect other resource values. These conflicting demands raised problems related to the map scales used for planning, protection of species and wildlands, forest conversion and simplification, fragmentation, pesticide use, and conservation of genetic resources.

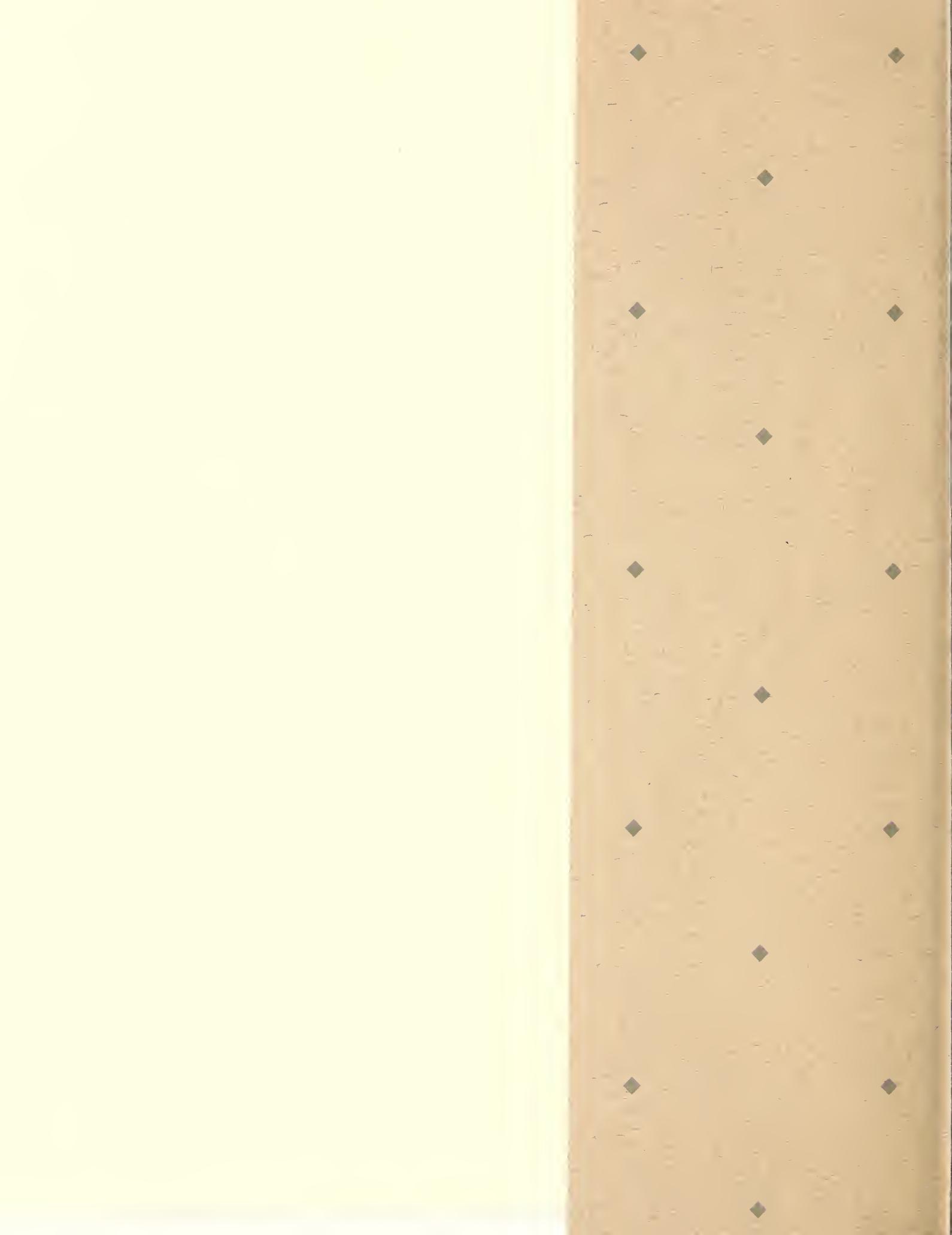
While addressing these questions, the Forest Service continues to play many roles in conserving biodiversity, including renewable resources research, international forestry, aid to state and private forestry organizations and individuals,



Sockeye Salmon. Photo: USDA Forest Service. Gray Wolf and Pups. Photo: L. Rogers. Top: Snowshoe Hare. Photo: L. Rogers.

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and, of course, stewardship of the National Forest System.

By virtue of its size and geographic breadth, the National Forest System ranks chief among the country's most important reservoirs of biodiversity. Indeed, the majority of nonmarine species in the United States probably occur somewhere on national forest lands.

The Forest Service strives to emphasize certain aspects of biodiversity in managing National Forests and National Grasslands, which cover 191 million acres from subarctic Alaska to tropical Puerto Rico—an area larger than the State of Texas. Scientists and resource managers are developing new knowledge and technologies that affect biodiversity such as population viability, ecosystem restoration, landscape ecology, habitat isolation and fragmentation, analysis of cumulative effects, and genetic variation.

The Forest Service also helps conserve biodiversity on state and private lands through cooperation and technology transfer with land managers in such areas as forest management, water quality, fire management, tree planting and breeding, and nursery management. Examples of current Forest Service efforts on biodiversity follow.

### **Management**

- ◆ Renewing productive forests, rangelands, and wetlands to sustain ecological conditions that serve people's many needs, for example, by restoring the fire-ravaged Klamath and Stanislaus National Forests in California.

- ◆ Enhancing species that people value as resources, such as trout, pines, elk, wild turkeys, hardwoods, and salmon through *Rise to the Future—Fish Your National Forests* and similar programs.
- ◆ Managing for restoration and recovery



of rare plants and animals, for example, through prescribed burning of jack pine for Kirtland's warbler.

- ◆ Conserving special habitats through management plans that specify essential features, such as the number of snags, and through designation of riparian zones as sensitive habitats.
- ◆ Developing interpretive activities, such as the waterborne Alaskan Marine Highway program, which educates people about natural and cultural resources in southeastern Alaska's Tongass National Forest.

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*Mendenhall Glacier, Alaska.*  
Photo: R. Szaro.



◆ Establishing Research Natural Areas to maintain representative ecosystems and to study their management, beginning in 1927 with the establishment of Santa Catalina Research Area near Tucson, Arizona.

◆ Maintaining stewardship of wilderness areas for their natural values.

◆ Integrating the protection of biodiversity as a goal in timber sales, such as the demonstration on the 25,000-acre Shasta Costa drainage of southern Oregon's Siskiyou National Forest to show that it is possible to manage compatibly for biological diversity and commodities.

#### **Research**

◆ Determining and developing methods to measure and monitor diversity of plants and animals, so that accomplishments can be gauged and objectives for biodiversity can be quantified.

◆ Improving our understanding of the ecological and economic implications of the landscape patterns created by past and present resource management—especially forest fragmentation, edge effects, and linkages among landscape ecosystems.

◆ Managing tropical forest ecosystems to achieve a balance between biodiversity

and resource production for people throughout the tropics but especially in Puerto Rico and Hawaii.

◆ Conducting research on sensitive species such as spotted owls, pine martens, and rare plants, so they can be managed to maintain viable populations throughout their geographic ranges.

◆ Developing techniques to renew degraded tropical forests and restore the habitat of endangered species.

◆ Conserving forest resources by pioneering methods to use low-quality wood and wood waste at the Forest Products Laboratory in Madison, Wisconsin, and designing structures that use less wood.

◆ Improving rangeland management by incorporating grazing in the natural disturbance process to promote healthy ecosystems.

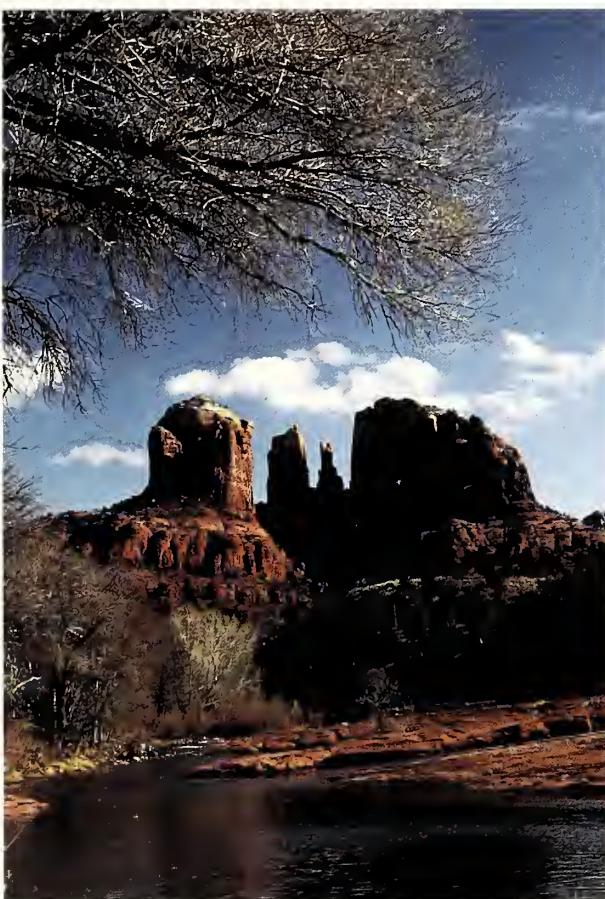
◆ Diversifying options in managed forests to address both ecological values and sustained forest productivity.

◆ Developing controls, such as host resistance or biological controls, for introduced pests, such as gorse or lantana, that threaten the biodiversity of trees and shrubs in native ecosystems.

#### **Cooperative Programs**

◆ Coordinating conservation plans and programs with international, federal, state, and private organizations through efforts such as the Keystone National Policy Dialogue and The Tropical Forestry Action Plan.

◆ Providing technical advice and incentives to private landowners by placing



Cochino National Forest, Arizona. Photo: R. Szaro. Top: Desert Spiny Lizard. Photo: R. Szaro.

up to 25 million acres of private forest land under stewardship within five years, thus helping landowners to use improved management practices that protect the environment, increase outdoor recreation opportunities, and provide options that meet their resource needs.

- ◆ Coordinating and improving comprehensive resource assistance to private forest landowners by supporting planning assistance before timber harvests and tree planting programs that ensure adequate regeneration of harvested stands.
- ◆ Increasing private landowners' awareness of the options available to promote biodiversity on their lands.

#### **PRIVATE-SECTOR PARTNERSHIP FOR BIODIVERSITY**

The Forest Service has long been assisted by The Nature Conservancy, a nonprofit conservation organization, to protect the variety of living things on national forest lands. A Forest Service-Conservancy partnership on behalf of biodiversity is a logical one. With decades of experience in managing its own preserves, now numbering more than 1,100, the Conservancy can offer practical advice to the Forest Service in managing its ecologically significant lands across the country.

The Nature Conservancy focuses exclusively on protection of biodiversity; its single purpose is to save the best examples of rare plants, animals, and natural communities throughout the world, and the public lands entrusted to

the Forest Service present significant opportunities to address that goal. Together, the Forest Service and The Nature Conservancy have embarked on exciting projects across the country, all of which are designed to safeguard biodiversity. To complete these projects, the Conservancy turns to state natural heritage programs, which now exist in every state. These Conservancy-designed programs amass detailed information about the location and status of plants, animals, and natural communities on a state level and maintain it in a sophisticated nationwide network of data bases.

The Nature Conservancy helps the Forest Service conduct preliminary research to find and recommend areas for designation as Research Natural Areas (RNAs). Once RNAs are established, the Conservancy often continues to work with the Forest Service to examine policy and management issues for these sensitive areas.

Conservancy-Forest Service efforts also include inventories of biological resources on national forest lands, public education through publications and conferences, management of sensitive lands and species, and one of the most useful services the Conservancy



*Saguaro Cactus Flower. Photo: R. Szaro. Tonto National Forest, Arizona. Photo: R. Szaro.*



performs for the Forest Service—acquisition of biologically significant land. The Conservancy brings formidable assets to this task: a substantial revolving land purchase fund, field offices covering every state, a skilled staff of real estate lawyers, experience in land negotiations for itself and public

agencies, and the private sector's ability to move fast whenever opportunity arises.

Examples follow of the Conservancy's role in collaborative projects with the Forest Service to protect biodiversity.

#### **Research Natural Areas**

- ◆ Writing "establishment records" for potential RNA sites throughout the West: 32 in California alone, plus sites in Arizona, Idaho, New Mexico, Utah, Wyoming, and Nevada.

- ◆ Developing establishment reports for RNAs in all 15 eastern national forests, including Green Mountain, Vermont;

White Mountain, New Hampshire; Shawnee, Illinois; Huron-Manistee, Michigan; Finger Lakes, New York; and Monongahela, West Virginia.

#### **Biological Inventories**

- ◆ Conducting inventories of natural areas in many national forests, among

them San Bernardino, in California; Mark Twain, in Missouri; Daniel Boone, in Kentucky; Ouachita, in Arkansas; and Kisatchie, in Louisiana.

- ◆ Conducting inventories along the Appalachian Trail as it winds through parts of New Hampshire and Vermont (through state natural heritage offices).
- ◆ Focusing a biological inventory of Pennsylvania's Allegheny National Forest specifically on rare plants and mussels.
- ◆ Helping the Forest Service prepare a Sensitive Species List for national forests in all midwestern and most eastern states.
- ◆ Developing a regional classification system in the Southeast for natural communities in national forests, focusing on methods to map and collect data.
- ◆ Jointly funding a specialist in forest classification in Montana, who works with a Biodiversity Assessment Team charged with identifying an agenda for policy makers to preserve biodiversity. Also in Montana, the Forest Service is funding a Conservancy botanist to provide assistance in its rare and sensitive plant program.

#### **Information Dissemination [Publications and Conferences]**

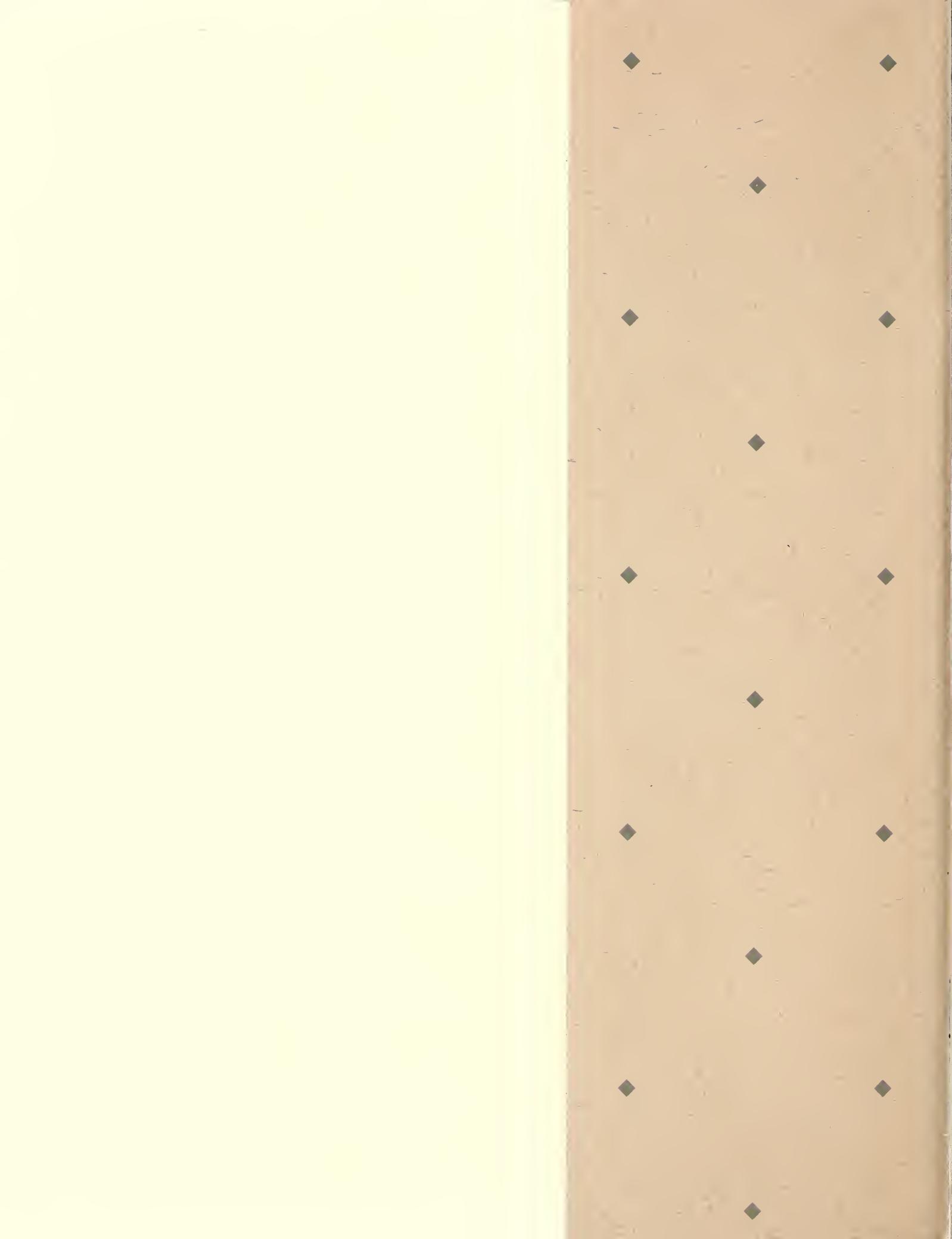
- ◆ Publishing a Forest Service brochure on RNAs in the Pacific Southwest Region.
- ◆ Identifying areas that harbor the greatest diversity and most imperiled species in forests in Maine, New Hampshire, Vermont, and New York (through state natural heritage offices).



*Black Bear and Loon Photos:  
Mike and Carol Ladd Photo;  
Common Tern Photo:  
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TOGETHER, THE FOREST SERVICE  
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The Forest Service will use this information to help prepare the Northern Forest Lands Study Report.

- ◆ Helping to establish the Upper Great Lakes Biodiversity Committee for Minnesota, Michigan, and Wisconsin, a 15-member multi-agency group charged to start from a broad, regional perspective in formulating recommendations for the sponsoring agencies, which include the three state Departments of Natural Resources.
- ◆ Sponsoring a conference on biodiversity in the Upper Great Lakes with Hiawatha National Forest staff in Michigan.

#### **Land and Species Management**

- ◆ Compiling information in abstract form for 42 rare plant species in the Midwest and East. This Element Stewardship Abstract project eventually will provide management information for all regional sensitive species.
- ◆ Creating Species and Habitat Management Guides for sensitive species in the West, including 27 in California.
- ◆ Cooperating on a time-critical project focused on management of lupine, vegetation needed by the extremely rare Karner blue butterfly, in Huron-Manistee National Forest, Michigan.
- ◆ Providing bufferlands for better management of the red-cockaded woodpecker in Texas by helping the Forest Service to consolidate its holdings. The Conservancy now acts as a third-party monitor for this rare species.
- ◆ Building fences and rerouting trails

with volunteer work crews to protect sensitive species on Forest Service lands in the West.

#### **Land Acquisition**

- ◆ Incorporating the Panthertown Valley as part of the Nantahala National Forest



in North Carolina. After protracted negotiations with the land's owner, nearly 6,300 acres in three northern counties—known to harbor at least 13 globally rare species—today are protected public lands for recreational use only, with restricted vehicular access.

- ◆ Helping to complete proposed RNAs in the Shawnee National Forest, Illinois, by stepping in to acquire inholdings and round out the RNAs.
- ◆ Purchasing an inholding near a wilderness area around Washington's Noisy Creek for resale to the Forest

*Superior National Forest, Minnesota.  
Photo: L. Rogers.*



Service through the Land and Water Conservation Fund. The Conservancy continues to work with other owners in the area on appropriate use of their lands.

- ◆ Acquiring three biologically important areas for Kentucky's Daniel Boone National Forest, including expansions along a river with rare mussel species. The Conservancy's deeds provide additional protection for these areas by restricting mining and cutting here.

◆ Securing core acreage in Florida's Pinhook Swamp, a critical wildlife and hydrological corridor between Osceola National Forest and Georgia's Okefenokee National Wildlife Refuge, which together form one of the most important swamp/river ecosystems in the nation.

#### **WHERE DO WE GO FROM HERE?**

The greatest challenge to conserving biodiversity today is preparing for the environmental changes that loom in the future. Many of these changes will result from human activities: global climate change, human population growth, deforestation, and toxic waste.

All of us must work to mitigate the effects of such changes. But we cannot protect biodiversity simply by preserv-

ing natural areas and trying to prevent change caused by nature or people. Nor can we conserve biodiversity by concentrating our efforts on the variety of life on any particular site.

To perpetuate all forms of life, we must protect the full variety of our genetic resources, species, and ecosystems. That means we need to understand how populations and ecosystems function. We need to make prudent decisions about how to sustain their productivity for *all* values and uses—not just for the sake of other species, but for ourselves.

Biodiversity is the foundation underlying all human resources. To a large degree, it will determine the future richness of life available to our children for generations to come.

The conservation of America's biodiversity is a tremendous challenge. We are making progress, but with a growing sense of urgency to save as many species as possible, we have to make tough decisions and take decisive action. Following are some things we think are important to a strategy to conserve biodiversity.

#### **Policies and Programs**

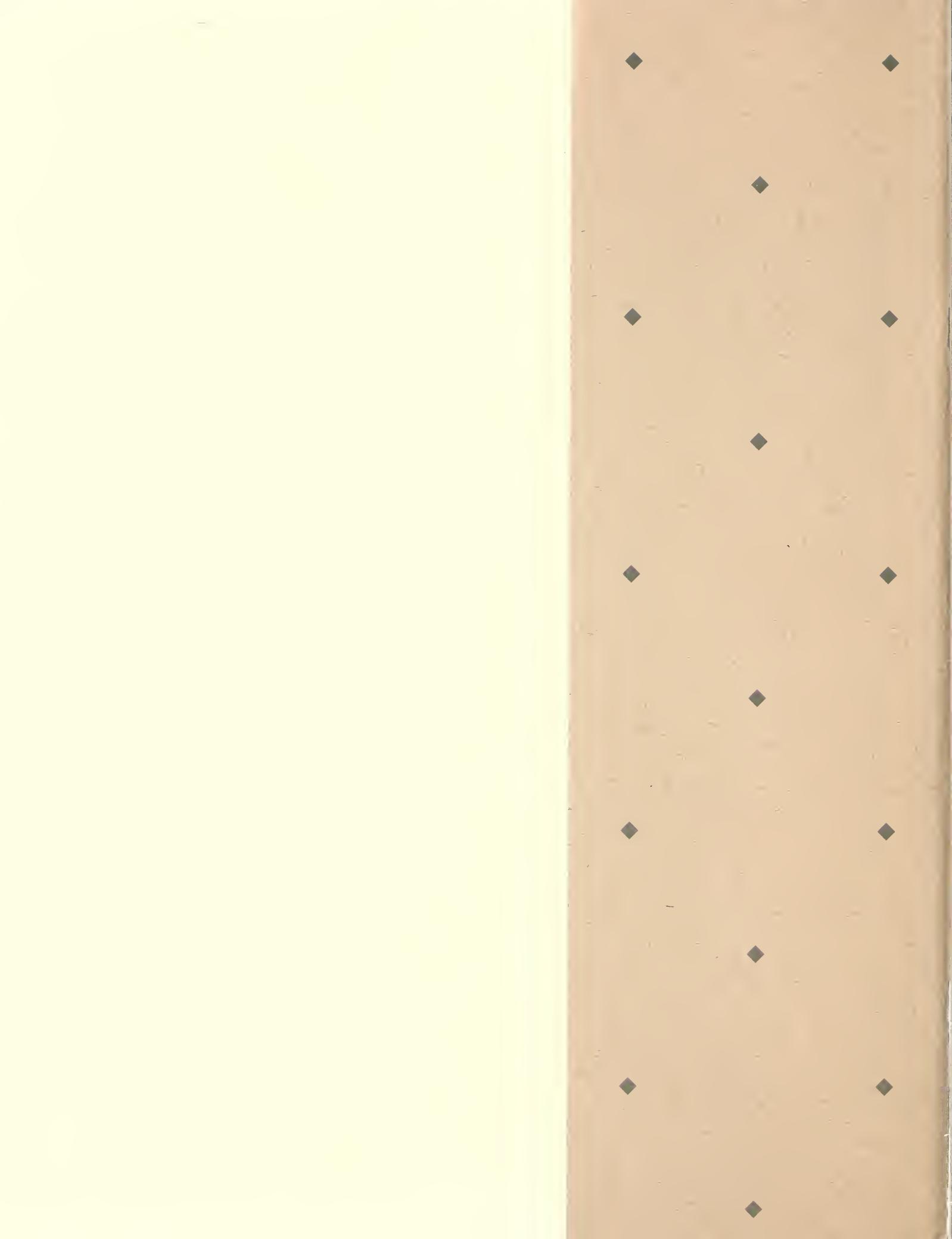
The nation needs clear, concise, and well-understood policies and programs for protection, renewal, recovery, restoration, and sustainable use of biodiversity resources. These policies must be consistent with scientific knowledge and legal requirements, and they should be coordinated among all agencies and organizations—public and private—that have responsibility for natural resources.



Croatan National Forest, North Carolina. Photo: R. Szaro. Top: Trumpet Pitcher-plant. Photo: R. Szaro.

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## Resource Management

We are learning to manage genetic resources, species populations, habitats, ecosystems, and human activities to achieve specific goals for biodiversity. This will include:

- ◆ Using biological inventories—of genetic resources, natural communities, and ecosystems—to assess trends in biodiversity in different parts of the country.
- ◆ Managing habitats to enhance the viability of species listed as threatened, endangered, or sensitive.
- ◆ Focusing special attention on species that are sensitive to human activities or anticipated environmental trends.
- ◆ Protecting rare, unique, and highly productive communities of plants and animals.
- ◆ Managing biological resources to allow for sustained use of species that people value for commerce, recreation, or subsistence.

## Dialogue

We are bringing agency personnel, private enterprise, and interested citizens into the process of developing policies to conserve biodiversity. We do this by holding regional workshops and national and local policy dialogues so that everyone can contribute to the formulation of a national conservation strategy.

## Research and Development

More knowledge is crucial. We are expanding research to improve our understanding of issues that affect biodiversity, develop approaches to problem-solving, and provide guidelines to resource managers. Initial research will focus on the following key areas:

- ◆ Identifying which species are sensitive to human activities that could diminish biodiversity at the genetic, species, or ecosystem level.
- ◆ Developing measurable indicators for monitoring changes in biodiversity.
- ◆ Prescribing resource management methods to achieve goals at each level of biodiversity and to create and maintain desirable habitat conditions.
- ◆ Creating new tools for testing and verifying that resource management is achieving its goals.
- ◆ Understanding ecosystem functions and processes, particularly the cumulative effects of management actions on the ecology and viability of populations and communities.



*Fiddler crabs. Photo: R. Szaro.  
Green Treefrog. Photo: D. Parish.*



- ◆ Examining the effects of both spatial and temporal aspects of habitat patterns, including fragmentation, on species interactions, community structure, and ecosystem processes.

### **THINKING GLOBALLY**

Biodiversity today builds on the Forest Service's rich legacy of forestry, wildlife, range, fishery, and watershed management in this country while providing a new focus for conservation programs that address multiple uses and values.

*Yellow-throated Vireo. Photo M. Hopiak. Prairie Grassland. Photo: by H. Payne.*

The Forest Service is increasingly called upon to lend its technical expertise worldwide on biodiversity concerns. The key to maintaining global biodiversity is sustainable ecosystem and landscape management, not crisis management of an ever-expanding number of endangered species: the time to save a species or ecosystem is when it is still common. Partnerships with groups such as The Nature Conservancy help further this goal.

Much remains to be learned about managing wildlands for biodiversity. The Forest Service must meet this challenge by adopting and testing new information as it becomes available, and partnerships with groups such as The Nature Conservancy help by supplementing federal resources and expertise.

But more cooperation is needed. Only through better cooperation among scientists, managers, and a concerned society can all of us achieve the goal of a rich and varied natural world for the future.



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